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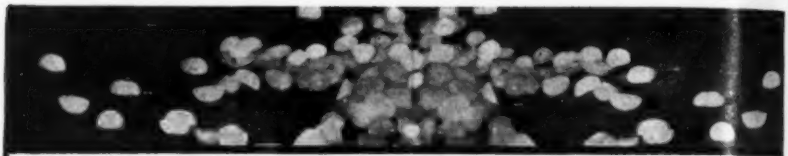
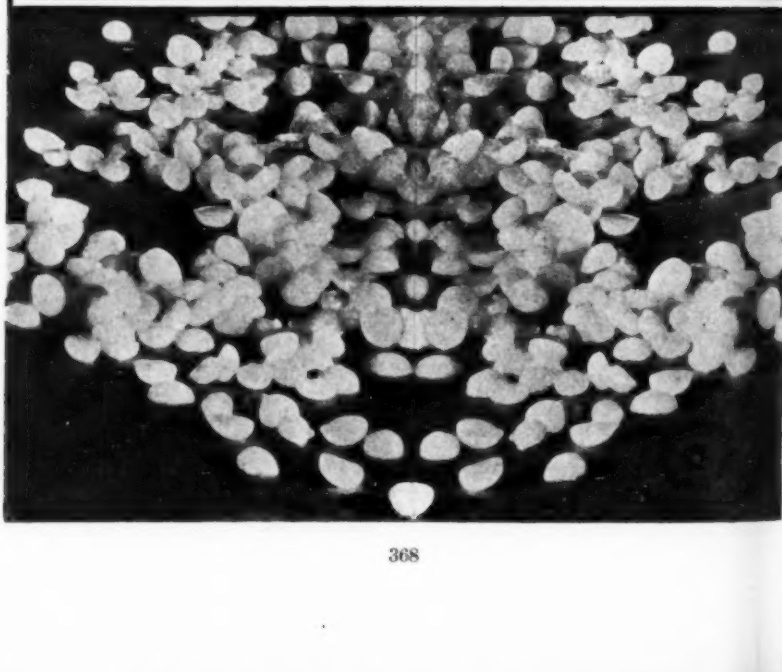




EDITORIALS

General Aims

THERE lie before *The* CHEMIST several possible courses. Shall we deal with the affairs of The American Institute of Chemists or of the entire profession? Shall we try to interest the general public? Shall we go to the extreme of scarehead sensationalism?

Service to the profession at large is probably the best way of serving the Institute. *The* CHEMIST ought to discuss

(*a*) Chemists in their relation to the nation's health, happiness, and material wealth.

(*b*) The professional problems of chemists.

(*c*) News.

Most of these can be put in a form that will be attractive to the intelligent public.

Abortive crusades are worse than useless. An organization can only assist in the operation of the general law that an increase in personal wealth represents a still greater contribution to the wealth of society. *The* CHEMIST hopes to point, not too self-consciously, to some achievements of chemists.

Related subjects at once come to mind. An increase in the country's wealth is of no value unless the security of that wealth is guaranteed as well. In case of war would America be handicapped by a lack of scientifically trained men? If it turns out that the national defense requires more chemists than industry can support, who is to bear the extra burden?

There are other interesting questions: Is present-day research largely destructive of values? We think not, but we are open to conviction. Ought foreign competition be dealt with by retrenchment or by increased research effort? Has America too many chemists today as a result of wartime over-production? Is there justification for the charge that present chemical education is sterilizing in its effect? These are only a few of the problems for which *The* CHEMIST ought to seek answers.

There are several special studies, also, which *The* CHEMIST ought to undertake or foster. Can psychologists devise vocational tests which will enable us to classify chemists as to their particular aptitudes?

The chemical industry needs every type of mind, whether primarily ingenious, thorough, deductive, inductive, critical, or original; but all are by no means suited to the same job. An employer now knows of a man merely that he has certain degrees. Recommendations mean nothing specific. We should like to see all chemical employment in America concentrated in one clearing house, where the manufacturer can find exactly the man he wants, where a chemist can find a job exactly suited to his ability. Every day chemical industry pays a large bill for its square pegs in round holes.

In general we hope to keep the pages of *The* CHEMIST open, under the perhaps naïve theory that truth tends to prevail in free discussion. If Soviet Russia has anything to say about chemists we shall be glad to hear it. We shall be equally glad to listen to Russia's opponents.

We see, then, *The* CHEMIST as a magazine which will lead the profession to a better understanding of itself and its problems, and which will give the rest of the world a clear idea of the chemist and his great importance to modern civilization. Such material ought to be of interest. The Chemical Foundation has given us a splendid start on the road. And the influence of *The* CHEMIST will grow in proportion to the ability with which the program is carried out.

Labor Costs

THE country is awaiting the full effect of wage cuts by the United States Steel and other corporations. First results were salutary, judging by the rise in the stock market and the general optimism about the business future.

In this connection it is interesting to note the experiment of the Monsanto Chemical Works, who have gone against the present trend by raising wages in the St. Louis plant.

During the second quarter of 1931, Monsanto paid to production labor 10.4% more than the average hourly rate paid in the second quarter of 1929, yet the labor hours consumed per unit of output declined 23.7%. The labor cost per unit of output declined 15.5%. Commenting on this result, Edgar M. Queeny, President, states:

"The chemical industry has never paid top wages to its operating workers, who have been recruited largely from the common labor group and then trained to operate chemical equipment. We felt that with a large surplus of high type of labor available we were accorded an opportunity to raise the standard of the average worker in our plants The

1929 wage rate, we felt, would not be sufficient to hold a high type man permanently if and when business returned to its former level of activity. We therefore set a scale which we believed would continue to attract the best of unskilled men in normal times, systematically weeded out the less efficient of our workers, and replaced them with the cream of the many applicants that appear at our employment office every morning.

"The experiment has been distinctly successful; and barring a further slump in the chemical markets, or further downward adjustment of costs of living, which we do not anticipate, or other unforeseen conditions, we feel there is no justification to lower our prevalent wage scale.

"Our new policy has given us the benefit of lower labor costs and a better grade of employees, and employees who have effected this saving are receiving approximately 40% of it in increased hourly rates."

It looks to us as if Monsanto is merely finding out what has been known for a long time, that high-class men, like high-class machines, produce high returns per dollar invested. There seems to have been a definite weeding out of the less competent workmen. A higher yield per dollar of wages seems only natural.

The Monsanto findings will doubtless be quoted in support of the theory that *general* increases in wages would be advisable. General increases may be advisable. We are not prepared to discuss that. But we do feel that the Monsanto experiment in no way proves the contention.

We should like to see the effect brought about by raising wages and keeping the *same* men.

Quick Action

THE admirable editorial, "Why Be Idle?" in the September issue of *Industrial and Engineering Chemistry*, contains the suggestion that unemployed chemists use the country's idle laboratory space in some arrangement of advantage to both chemist and company. As a practical step in this direction, the Employment Bureau of The Chemists' Club, under the guidance of Mr. D. H. Killeffer, has undertaken to act as a medium for making the arrangements.

It is seldom that editorial suggestions are put thus quickly into operation. Chemists with ideas ought to communicate with Mr. Killeffer at 50 East 41st Street, New York City.

At the same time Mr. Killeffer will be glad to know of research laboratories now lying idle which might be used by these chemists.

The Chemist in Industry

By M. L. Crossley

A leading chemist-executive appraises the value of science in the business world and points out some of the pitfalls a chemist must avoid.

MODERN industry is complex. It has evolved, in large measure, from the discoveries and inventions made possible by the accumulated knowledge of the human race. At the dawn of human intelligence man was endowed with the "bump of curiosity" which has been the mainspring of his invincible spirit of endeavor ever since. Back of every great industrial achievement is a story of thrilling adventure which required courage, self-sacrifice, and perseverance to overcome obstacles in the exploration of the unknown, that ultimately fundamental truths might be discovered and applied in industry. Few of us realize the full significance of these achievements in making possible the things which contribute to our comforts and enjoyment. That life is fuller and more worth while we may admit, but we seldom think deeply enough to realize the importance of the things we are privileged to have. Things are seldom appreciated to their fullest extent while we have them. It is only after we are deprived of them or when we pause in our daily routine life to let the mind journey into the realm of the abstract that we become conscious of the immensity of life and of the significance of the things that contribute to its fullness. Then we see life as a fabric, woven of threads of scientific and technological achievements, before whose marvelous manifestations we stand in utter amazement.

The comforts of life which were once the privilege of the few are now shared by the many. This has come about largely by the application of chemistry in industry. In this the chemist has played a conspicuous part. He has created things which contribute to the safe-

guarding of health and to the enrichment of life, assuring a fuller meaning of life to mankind in general. His imagination, knowledge, and skill have made it possible for us to have the delicate fragrance of the flowers, the beauty of an autumnal pageantry of colors, and the potent remedial power of drugs, without drawing on Nature's storehouses. In fact, many of the products produced today have no counterpart in Nature. They are creations called for by modern social and economic conditions and represent the pillars on which the superstructure of industrial progress rests.

The Chemist's Part in Industry

In the vortex of industry the chemist is struggling to turn the eddies in the direction of the main current of progress. His success will depend upon his fitness for the struggle and upon his capacity to appreciate the possibilities for service in his position. He must be prepared to understand the economic aspects of his work and to evaluate his results correctly, so as to guide industry wisely. He must have the ability to secure the available facts bearing on his problems and to correlate all information secured, so as to get a thorough understanding of the limitations as well as the possibilities of each problem before undertaking its solution.

Must Have Open Mind

The industrial chemist must be open-minded, alert for new facts, but equally ready to discard what he has treasured as truths when they are proved to be false or misleading. The storage of useless facts can be very costly both to the chemist and to industry. The industrial chemist has to appreciate the fact that success depends as much on his willingness to unlearn as on his desire to learn. To learn to unlearn is one of the most difficult lessons in all of life's experiences. It is natural to want to hold on to the facts that have been accumulated, believing them to be a permanent asset. It is not natural to want to give up anything that has cost effort and time to secure. The industrial chemist must continually compare the facts at his command with new experiences and fearlessly evaluate them, eliminating all that appear at the time to be false. The process of securing a working knowledge in chemistry is like that of assembling a picture puzzle from a large and constantly growing number of parts of different shapes and colors, secured from widely different sources. With the parts available at any particular time a definite picture is visualized; but as new parts are received, the vision of the picture changes. Some of the parts

which had seemed essential to the symmetry and completeness of the old picture fail to fit into the new and may be discarded—but not permanently. Another lot of parts may require the old, previously discarded parts to complete the new picture and secure the desired effect. So with ideas; the chemist should not hesitate to use what had been previously rejected, if the new information demands it. It is essential that the chemist should not become so satisfied with his mental pictures as to wish not to change them. If he does, he limits his capacity for service.

Intelligent Planning Necessary

The kind of service a chemist renders should be the chief criterion of his worth. He must school himself to reach his maximum output per unit of time easily and effectively. In particular, it is imperative that the research chemist keep in mind the cost of doing his work. There is more waste in research due to inadequate conception of the cost than to any other single cause. A complacent attitude which results in doing an experiment when the spirit moves and in the way that just comes to mind or on "a hunch" is in accordance with neither scientific nor economic principles. Research, to be effective, must be planned; and the plan should embrace a number of experiments which can be conducted at the same time, so as to reduce the unit cost of the work and also to get the maximum efficiency and accuracy by performing related experiments, as nearly as possible, under the same conditions. It is the research chemist's responsibility to eliminate waste in research and to see that his time is spent efficiently. This question of waste in research is one which should never be over-looked. It is one of the biggest problems in the chemical industry. It has many aspects. In the first place, considerable money may be wasted in the attempt to improve costs by improving process, when a simple calculation would show that the possible improvement would not save enough to pay for the research; or it may be that the volume of sales was too small to justify the cost of the research. In such a case it would be wiser to spend the money which it would cost to improve the process in sales research to develop a larger market for the product.

New Uses Important

The responsibility of the industrial research chemist for developing uses for products is just as great as it is to create new processes and products. The thrill that one gets in discovering something new is apt to become an ague with time unless a use is discovered for the prod-

uct and the potential market convinced of its value. Furthermore, it is not enough that the product be new; it must possess advantages over existing competitive products to justify the investment involved in making and selling it. From the economic point of view the advantages must be real or novel to justify the loss in capital which would result from the displacement of the product then filling the need. Of course, this actually happens only in very rare cases. What is more common is the division of the market between the two products with a resulting drop in sales volume for the old product. This in effect is overproduction of the commodity to meet the existing need, and either the surplus plant capacity must be used for something else or more money must be spent to develop new or to extend existing markets for the products. This type of research has been destructive of much capital and is still one of the aggravating problems of economics in the chemical industry.

Results of Overproduction

The industrial chemist is responsible for seeing that the investment required per unit of production is not so high as to reduce the return on the investment to the vanishing point. This is largely the situation at present. It is one of the economic problems which resulted from the World War. Anybody who had money to invest felt that the chemical business offered unusual opportunities for returns and without adequate investigation built a plant and started to manufacture. The more manufacturers already making the product, the more attractive the field appeared to be. The results we are now witnessing. Most of these plants have had to give up; but their investments in plants and sales endeavor, "good will," have been saddled on the owners of the stock of the remaining chemical industries; and this means that the earning per dollar of invested capital is less than a sound business demands that it should be. It is hard to see who has been benefited. There has been a lot of money wasted in duplication of effort and material equipment, and the result is idle plants and unemployed chemists. The readjustment is coming about now, and the public is paying dearly for the uneconomic procedure.

The chemist should advise against this wholesale squandering of the investors' money. It is equally important that the responsible industrial chemist should advise against overexpansion in the chemical plants that have survived. When there is more than ample capacity for the production of a product, the chemist should not advise his company to duplicate research and, presumably, plant and sales invest-

ments to enter the competitive market unless he is sure that his company has some marked advantage in raw materials, synchronization with other processes, lower potential cost or sales position.

Chemical Foresight

Other economic aspects of business which the chemist must watch closely are the trends of the developments in the business consuming the chemical manufacturer's products and new discoveries or inventions which might upset the markets for chemical products. What effect, for instance, will radio advertising have on the chemical business? Will it result in less journal advertising and, if so, what will be the effect on the sale of inks and paper? If these two industries are adversely affected, their consumption of chemicals and dyes fall off; and correspondingly the volume of sales of the contributing chemical industries is reduced. It is obvious that the industrial research chemist should not wait until the sales drop off to develop new markets for the products. He must anticipate such changes.

The industrial chemist must be aware of the developments and potential needs of industries not now consumers of his products. Frequently this means that he must visualize the possibilities and carry his investigations far enough to obtain results which are convincing to him and to the prospective customers.

An Economic Evaluation

Enough has been said to indicate that the chemist's work is vital to the progress of civilization. It is also clear that his contribution to industry can be evaluated on an economic basis. Custom has decreed that the results of his work shall be hidden away among the intangible assets of industry and that he shall be regarded as nonproductive, while the salesman who sells the product the chemist creates is productive. What basis is there for this arbitrary distinction? I can see none. The product of the chemist's work—the chemical process—is just as tangible, so far as the earning power of the company is concerned, as the buildings and equipment or the tangible assets; and it is equally susceptible to mathematical treatment to ascertain its true value.

To determine the contribution a chemical process makes to the earning power of a plant it is only necessary to weigh the three factors which are responsible for earnings. They are the chemical process factor, the human factor, and the plant and equipment factor. The relative importance of each of these can be estimated with a fair degree of ac-

curacy. A weighted estimate of the relative importance of the three factors in any case must take into consideration: the importance of the process, the degree to which supervision is essential to its efficient operation, the sales effort required to sell the product, and the degree to which the success of the operation is due to the plant and equipment used. The process factor may then be called "the factor of process in earnings." The other factors needed to estimate the value of the process are: the estimated net earnings derived from the sale of the product, and the life rate of the process. This can be estimated by taking into consideration the novelty, efficiency of the process, and the chance of its becoming obsolete within a short period of time. The value of the chemical process is then some factor times the earning power and may be expressed by the following formula:

$$V = \frac{10\,DC}{1 + 10\,DA}$$

In which A = the life rate of the process
C = the estimated annual profit
D = the factor of process in earnings
V = value of process

The value of the process is amortized over the life of the process. It is assumed that a fair value is 10 times earning power. This would vary with business conditions and could be changed in the formula without altering the principle involved.

The industrial chemist must recognize fully the significance of his work and prepare himself to discharge the obligation of his profession with the highest efficiency and with dignity. He must win public esteem and merit the confidence which leads to economic reward commensurate with the high order of service rendered.

A Plan for the Jobless

By D. H. Killeffer

The manager of the Employment Bureau of The Chemists' Club tells chemists how they can defeat the depression. Unemployment as the breeding ground of initiative.

JOBS for chemists become scarcer and those seeking them more abundant. To avoid serious consequences job-seekers must be persuaded to attack the problem from a fresh, totally different point of view from that of past months. Our purpose here is to suggest a possible basis for such new attacks.

Industry divides itself roughly into three categories for our present purposes: chemical, semi-chemical, and non-chemical. It is a fairly safe guess not only that the chemical industries are fully familiar with possible services chemists may render them, but that they have been canvassed and re-canvassed so often by job-seekers that their job-giving possibilities are practically exhausted for the near future. What may be termed the semi-chemical industries, too, have long ago reached their practical limits of absorption for chemists except for moderate growth. Such things as chemists generally might accomplish for them are reasonably well understood by their executives, so that if more of that kind of thing is required they are already in a position to get it. In other words, it is obvious that unemployed chemists, except those of extraordinary abilities, will find cold comfort in either of these directions. Yet it is definitely to these two groups that unemployed chemists consistently address themselves. Continued canvassing of these fields can only darken the blue of the future, already threatening, for many, to shade into deep violet. If one wishes discouragement, there is where it lies.

Is it not folly to pursue only the beaten paths to disappointment? Who, if not the chemist trained in creative thinking, should blaze new trails now? Who else can be expected to explore new fields so well, and when else is the opportunity so great as now?

New Attack Necessary

Industry is groping blindly in its efforts to meet the new conditions brought about by the change in the economic base line forced upon it by the present depression. Everyone is seeking light and guidance to avoid ruinous pitfalls all about. Strange as it may seem to those of us familiar with the vast amount of public attention chemistry and chemists have received in the past fifteen years, there are almost countless companies, large and small alike, which know nothing of what applied chemistry might do for them. If, in truth, chemists can accomplish the things they claim, no better time than the present can be found to demonstrate it. Proof is required, but proof of a kind seldom difficult to educe.

To attempt to tell here what might be accomplished by such an attack is unnecessary, but it is possible to point out a general line of strategy which has heretofore succeeded.

The purchasing agent for a small railroad system prided himself on his acumen in assuring himself the lowest obtainable prices, and was wont to insist on buying ordinary soap by the pound, instead of by the piece. It was a simple matter for a young, enterprising chemist to show him how easily certain soap makers could sell him water at soap prices. The saving effected on this item alone very nearly paid that young man's salary.

Proof of Value Required

In this case, as in all others of the kind, it was necessary for the man to prove that he could produce value. We may easily picture such a youngster approaching his man with the query, "Do you want to hire a chemist?" and the prompt negative reply. It is impossible, however, to imagine quite the same reply to an approach based on knowledge of the purchasing agent's problem. On the first or perhaps on the second visit, the chemist secured samples of the soap being bought and on his third call was able to point out that each ton of purchased soap from manufacturers A, B, and C represented 1300, 1400, and 1500 pounds, respectively, of actual soap. It is obvious that soap is not all soap, and there is a very reasonable chance that the answer now to the same query will be different.

This, of course, is quite the simplest kind of case, yet it illustrates very clearly the point of correct approach. The purchasing agent's objective was to save his employer's money, and by learning first how he could assist in attaining that objective, proof of his ability was relatively simple for the chemist to produce. The hiring of a chemist in this case was entirely an incident to the saving of money.

So must it always be subservient to the accomplishment of some task, the solution of some problem. An employer might possibly hire a chemist for show, as the social climbers are reputed to hire butlers, but not for long. Value produced is inescapably inherent in employment, and the chemist's real problem today is to convince an employer that he can produce a value greater than his cost.

Especially at this time, employers everywhere are earnestly seeking ways to economize, ways to increase profits now miserably small. It is difficult to imagine an employer today buying a "pig in a poke," which is the thing most of the unemployed expect of him. At the same time he would be foolish indeed who overlooked an opportunity to build his business or save it from possible ruin.

The Specific Cure

Reduced to its simplest terms the procedure here suggested is:

First, study the problems of someone you know or to whom you can be properly introduced. You can be sure he has problems even if he and his business are in your own home town. Too many see opportunities afar by craning their necks over those at home.

If your study (and nothing cursory will do) shows you a way to help, propose to accept part of the saving you effect as your compensation. It is, of course, absurd to expect more than that.

When you have succeeded with one problem, tackle another. When your value has been proved, you may expect to be paid for it and when it has been increased, then you may expect to be paid more.

Probably few who read these words will be in the actual need of employment at the moment, but there will be none, we are sure, who do not number among their friends some who are. Let all help push such a campaign, for now, if ever, is the time when by so doing many good purposes will be served. The jobless may be employed, industry may be helped, and the possible future usefulness of our profession materially broadened by thoughtful introduction of creative chemists into new industries now.

Opportunities for Chemists in Latin America. *Part I*

By Henry Arnstein

America's greatest expert on the chemical industry of South America gives an encouraging picture of conditions below the equator.

HORACE GREELEY'S recommendation to the American youth to go West could be appropriately altered today to, "Young man, go South." I believe that there are more and greater opportunities for the young man in the Latin-American countries.

Latin America has learned the lesson of the War that no nation can achieve or maintain political independence unless the nation is economically independent. We in the United States are unwilling to reconcile ourselves to the changes of the day. During the War, when we had increased our manufacturing and agricultural facilities, we did not realize that with the cessation of hostilities we should be forced to seek foreign markets for our surplus crops and manufactured goods.

It is impossible to build a tariff wall to keep out foreign goods and at the same time insist on selling our products to those countries whose products we are unwilling to purchase. This is not intended as a political dissertation. It is intended only to point out a few elementary facts which will justify my statement that there are greater opportunities for the "practical chemist" in Latin America.

Realize Importance of Research

The Latin-American countries have learned that their prosperity depends on the exploitation of their natural resources; and as nature

was rather generous to the Latin-American countries, we may see great developments there in the near future.

In most Latin-American countries the governments are establishing experimental research institutes to study ways of building up industries that utilize native grown and produced commodities. The various Chambers of Commerce and newspapers are constantly calling attention to the fact that certain commodities are being imported which could be produced at home.

By popular subscription and by unopposed taxation, various branches of agriculture and industry are establishing experimental research institutes and laboratories, which are the best equipped the world has yet seen. These institutions are experimentally determining what species of plant life is best suited for some particular locality which lends itself readily to industrial exploitation.

The Oil and Fat Laboratory of the Brazilian Government has numerous plantations in various sections of the country, where all types of oil- and fat-bearing plant life are cultivated under truly scientific control. The laboratories contain small commercial scale apparatus for expressing the oil—hot or cold—by hydraulic means. They have well equipped solvent extraction plants, hydrogenating equipment, oil refining and deodorizing equipment, pressure and vacuum distillation equipment for glycerines and fatty acids, with all other laboratory paraphernalia. The student becomes familiar by actual operation with the processes and equipment employed in this field throughout the world.

Elaborate Chemical Equipment

Other industries maintain similar research institutes and technical schools. In Barreiros there is a sugar school and research institute devoted to the study of all problems relating to sugar, which is incomparably better equipped than our own sugar school at Baton Rouge, Louisiana. The institute contains an actual commercial size operating sugar plant with chemical, physical, and electrical laboratories generously equipped with all facilities for plant control and research work. They have one unit of each type of evaporator used in the industry. They have calandria—tubular, high-speed, and flash-point evaporators—which enable the student to compare the various merits and the economic advantages of each type of apparatus. It has just been decided to build an additional unit to the school, to be devoted to the study and recovery of the sugar factory by-products.

The plans call for the installation of complete distilleries using wood, steel, and metal fermenters—both of the open- and closed-top varieties—

HARBOR OF BUENOS AIRES

and continuous and discontinuous stills for both pressure and vacuum operation. These plants will be equipped to manufacture bakers' and fodder yeast, and liquid and solid carbonic acid, also with equipment to manufacture ether and absolute alcohol—both by the lime and benzol processes.

Complete chemical and biological laboratories of the most modern type are available, where all fermentation experiments and research can be carried out under absolutely controlled conditions. The fermentation rooms are to be equipped with thermostatic controls for air-conditioning equipment, which will enable them to maintain predetermined temperatures on large scale fermentation.

Experimental plants for the production of glycerine, acetone, butyl alcohol, and citric acid by fermentation are already available—experimental stations where the most exacting scientists will find all tools and facilities for research work and for plant control work on commercial scale.

To Develop Exports

Extensive automotive laboratories are available to study the relative merits of the various automotive fuels now used. The purpose of these laboratories is not only to develop properly trained native talent, but also to demonstrate that commodities which are now being imported can be produced from native products and with native labor.

It is not only desired to replace imported products with native grown

and produced commodities. The aim is to develop also a large export business. Most of the Latin-American countries have certain natural advantages, and natural resources not available in many countries. Instead of sending raw materials to foreign countries South America intends establishing industries to produce finished commodities for export.

All the Latin-American countries are now "industry-conscious." They are willing to learn and to be shown by the foreign chemists and engineers what can be done and how it should be done. The chemist who has had industrial experience can find in the Latin-American countries a fertile and profitable field for his activities.

Necessary Personal Equipment

His prime requisites, naturally, are a thorough knowledge of Spanish, and the ability to install chemical processing equipment and to operate it economically and profitably in small but commercial units. He must have tact to satisfy both his employer and subordinates, courtesy, willingness to co-operate, and ability to get along; and he must know how to interpret chemical reactions in terms of dollars and cents.

The chemist is expected to be able to demonstrate the results obtainable by the use of his products. Above all, he must never high-hat the native and act as though he were a super-man living on a higher intellectual plane.

By neglecting to show proper appreciation and consideration, many an American or European has found his advance impossible in the Latin-American countries. A chemist in the tropics must be a practical man, able to instruct and to supervise the handling of equipment.

When the writer was asked to make an economic survey of the Latin-American countries and to suggest new industries adaptable to those countries, he governed his recommendations by the imports and exports of the country and also by the known natural resources. For this reason, it may be advisable to give a few elementary economic facts and statistics:

Argentina

Area—1,079,965 square miles. Population—11,193,000.

Population of capital, Buenos Aires—2,128,992, an increase of 18% over the previous census.

Argentina has a total of about 25,000 miles of railways and over 400,000 automobiles.

It has a well-developed river navigation. The capital was entered in 1929 by 311 ocean going vessels with a total tonnage of over 300,000 tons.

Argentina is essentially an agricultural country. The area of arable land amounts to 64,479,000 acres. About 2,600,000 acres in orchards and vineyards are not included in this. Pasture lands are over 304,000,000 acres, and forests 186,000,000 acres.

The following table will show the agricultural crops for the last season:

Wheat	143,175,000 bu.
Rye	4,409,000 bu.
Barley	16,813,000 bu.
Oats	68,020,000 bu.
Corn	253,175,000 bu.
Linseed	55,621,000 bu.
Potatoes	25,461,000 bu.
Cotton	86,040,000 lbs.
Cane sugar	340,000 tons
Grapevines	218,229,000 gals.
Wool	323,400,000 lbs.
Cattle hides	2,791,000 pieces
Sheepskins	5,275,000 pieces

The pastoral industries of Argentina are well developed. While statistics are not up to date, in 1922 the country had 37,000,000 head of cattle; 36,000,000 sheep; 5,000,000 goats; 1,500,000 swine; 10,000,000 horses; and about 1,000,000 asses and mules.

The Argentine packing houses are among the largest and best equipped in the world and are famous for their chilled beef, which is carried to European markets at a temperature of 29° to 30°. All chilled beef is examined by government inspectors, making certain that the beef is free from disease.

In 1929 close to 3,000,000 head of cattle were consumed in the slaughter houses, which yielded 1,608,400,000 lbs. of beef. From 5,300,000 head of sheep, 218,600,000 lbs. of mutton were obtained. The slaughter houses also consumed 431,000 head of swine, yielding 63,000,000 lbs. of pork.

There is a well developed dairy industry, which produced over 70,000,000 lbs. of butter, 40,000,000 lbs. of cheese, and an equal amount of casein.

Argentina has a rapidly growing petroleum industry. In 1913 only 131,000 barrels of petroleum were produced. In 1929 the amount rose to over 9,000,000.

The quebracho industry is worthy of note, because we in the United States consume the major portion of that product.

Argentina has well developed textile, chemical, and leather plants; also distilleries, and sugar and glucose factories. Some of these plants are by far the most modern and best equipped in the entire world. Naturally, the largest industries are those which handle agricultural materials—meat packing houses, flour mills, sugar factories, creameries, and quebracho extract plants.

Plaza de Mayo, Buenos Aires

A large number of chemical plants utilize the by-products of slaughter houses—margarine and compound lard plants, in addition to glue plants, charcoal plants, black pigment plants, plants producing poultry food and fertilizers.

The mineral resources of Argentina have not yet been tapped. There are extensive lead, borax, silver, copper, zinc, vanadium, and tin mines; also sulphur, asbestos, mica, talc, salt, and even coal.

It is estimated that there are over 61,000 industrial establishments using a total energy of 1,000,000 horsepower and employing about 750,000 men. The Department of Commerce estimates the value of their production at $1,250,000,000.

It is natural that most of the industrial activity of the country should be centered around the capital, where 25% of the country's population live. Buenos Aires is a large, modern city, with a pleasant and healthful climate. There is a large English and American colony. One may even send his children to English elementary and high schools, not always a possibility when one is employed by a plant in the interior of the country.

A study of the principal imports and exports will clearly illustrate what has already been accomplished and will also show what can be done for further industrial development in this country.

Statistical Background for Certain Causes of the Depression

By David P. Morgan, Jr.

A consideration of the problem of overproduction and underconsumption. Comparison of the returns to capital and to labor in the years just past. Are we over-capitalized?

IT IS PRETTY generally agreed that the present depression has largely resulted from a maladjustment between production and consumption. Many other factors are pertinent. Still, there is little doubt that if the consuming capacity for our goods had grown at the same rate as our production capacity the present situation would be far less acute.

No doubt the situation has been aggravated by installment selling, speculation, and demoralized conditions in Europe. Probably one of the most serious contributors to our troubles has been the difficulty of gauging the proper expansion rate in a civilization based on large-scale production. Where additional production units cost millions of dollars and take a year or two to construct, it is difficult, indeed, to attune one's plans to a demand which may vary over a wide range of consuming capacities.

Many a panacea has been offered for the country's present indisposition. As the *Annalist* scornfully remarks: "Plans for the rescue of the country from the depression multiply. Most of them are fantastic, not worth the paper they are written on. In general, the results of these efforts seem to be limited to (1) securing undeserved publicity for their sponsors, (2) advertising the depression and thus causing additional retrenchment, and (3) increasing the general disposition on

the part of individuals to look to some outside agency for help instead of relying on their own initiative." How can we help to solve this problem?

It has been rightly said that a problem is more than half solved when it can be properly stated. The object of the present study is to throw more light on the situation that now confronts the country. How can a better adjustment of production and consumption be achieved? Clearly this question can be divided into two parts: First, what possibilities are there for increasing consumption; and second, what can be done in the way of curtailing production capacity?

I

THE problem of bringing about an increase in consumption may be approached through a study of the sources and distribution of the national income of the United States. For this purpose ample funds of data are available in Government and other publications.

According to the estimate of the National Industrial Conference Board, the national income amounted to some $84,000,000,000 in 1929. A bulletin of the Federal Tax Commission tabulates the sources of this income as follows:

TABLE I

NATIONAL INCOME BY SOURCES

Manufacturing industries	$28,600,000,000	34.0%
Agriculture	11,300,000,000	13.5
Mercantile business	10,500,000,000	12.5
Personal services	7,600,000,000	9.0
Professional services	6,300,000,000	7.5
Transportation	5,600,000,000	6.7
Mining and quarrying	4,100,000,000	4.9
Construction	2,100,000,000	2.5
Commercial banking	1,700,000,000	2.0
Miscellaneous	6,200,000,000	7.4
National income (before taxes)	$84,000,000,000	100.0%

This table gives a general idea of the relative importance of the different sources from which the national income is obtained.

From the point of view of the recipients of the national income a table provided by Chase in his book, *Prosperity, Fact, or Myth?* is interesting.

Table II

Share of the National Realized Income

	Billions of Dollars	Per Cent
Wages	32	38
Salaries	15	18
Pensions and benefits	1	1
Rents and royalties	11	13
Interest	4	5
Dividends	4	5
Profits withdrawn (mostly farmers and small business men)	17	20
Total	84	100

As the last five items in this table represent income received by capitalists or professional people in contradistinction to labor, it is interesting to total them. In this way it is found that 44%, or $37,000,000,000, of the national income is the share of this class. The remaining 56%, or $47,000,000,000, is the share of those who work for wages or salaries.

At the time of the 1920 Census the Government compiled the following information as to the total number of people in this country who were occupied:

Persons 10 Years of Age and Over in Each General Division of Occupations: Continental United States January, 1920

Class of Occupation	Number	Per Cent of Total
All occupations	41,614,000	100.0
Agriculture, forestry, and animal husbandry	10,953,000	26.3
Extraction of minerals	1,000,000	2.6
Manufacturing and mechanical ind's	12,819,000	30.8
Transportation	3,064,000	7.4
Mercantile business	4,243,000	10.2
Public service (not elsewhere classified)	770,000	1.9
Professional service	2,144,000	5.2
Domestic and personal service	3,405,000	8.2
Clerical occupations	3,127,000	7.5

A further insight into the distribution of income may be obtained from the following figures quoted by Mr. Chase.

AVERAGE INCOME PER EMPLOYEE FOR THE YEAR 1925
VARIOUS INDUSTRIES AND OCCUPATIONS

Group I—Laborers

Agriculture	$ 537	(mostly farm laborers)
Merchandising	1315	(shop girls and clerks)
Mining	1318	
Manufacturing	1362	
Transportation and utilities	1554	
Construction	1574	
Government employees	1585	
Banking	2179	(mostly clerks)
Unclassified	1408	
All groups	$1384	

Group II—White Collar Workers

Banking (per employee)	$2179
Government service	1585
Merchandising (per employee)	1315
Clergymen	735
Teachers, county schools, Middle Atlantic States	870
Teachers, village schools	1244
Teachers, high school, Middletown*	1575
Bank tellers, Middletown	1800
Young clerks, dept. stores, Middletown	520
Seasoned clerks, dept. stores, Middletown	1800
Male clerks, men's furnishings, Middletown	1800
Mayor of Middletown	3000
City Attorney, Middletown	3000
City Judge, Middletown	2100
Adding machine operators	1069
File clerks	990
Routine typists	1048
Telephone operators	1107
All college salaries	2958
All groups	$2000

* Middletown—a typical American community.

The National Industrial Conference Board in its book on the cost of living in the United States 1914–1930 selected $2000 per family per year as the minimum cost of living in this country. On this basis it is clear from the above table that ordinary laborers and most of the white collar workers must have more than one worker in each family.

One of the most interesting insights into the distribution of income in the United States is obtained from income tax returns. The following table shows the tax returns of 1927:

Table V

1927 Income Tax Returns

Income Class	No. of Persons	Total Net Income	Average per Person
Under $5,000	3,234,877	$ 8,708,354,000	$ 2,700
$5,000 to $10,000	543,509	3,759,149,000	6,900
$10,000 to $25,000	250,455	3,726,099,000	14,900
$25,000 to $100,000	82,334	3,571,123,000	43,400
$100,000 to $1,000,000	10,784	2,222,337,000	206,100
Over $1,000,000	283	586,256,000	2,071,000
Grand total reporting	4,122,242	$22,573,318,000	$ 5,500
Remainder of occupied	37,492,000	61,427,000,000	1,660
Total	41,614,000	$84,000,000,000	$ 2,000

Obviously it is incorrect to imply that the persons occupied in this country may be sharply divided into two distinct groups. However, it seems plausible to make a general distinction between a very large group of workers receiving an income around $1500 and a much smaller group receiving a great deal higher stipend. Mr. Chase quotes a statement to the effect that one-third of the country's national income is received by 10% of all the families. Ten per cent of the 27,000,000 families in the country is 2,700,000, who would share one-third of $84,000,000,000 or $28,000,000,000. The average income per affluent family on this basis is about $10,000. The remaining two-thirds of the national income, or $56,000,000,000 is divided among the other 24,300,000 families, or an average income of $2300 per family.

After a very extensive survey of the subject the National Industrial Conference Board adopted the following budget for a person living on the minimum family income of $2000:

TABLE VI

COST OF LIVING BUDGET

	Per Cent	$/Minimum Budget
Food	33	$ 660
Housing	20	400
Clothing	12	240
Fuel and light	5	100
Sundries	30	600
	100	2000

It does not take much experience with budgets to see that living on this standard has its limitations. Still, it is surprising to reflect that an increase of 20%, or $400 per year, applied to this whole group of 24,300,000 families would amount to some $9,600,000,000, or 10% of the present national income. This seems like a staggering sum, but it is of the same order of magnitude as the total purchasing power of $6,000,000,000, estimated to be financed by installment selling. Moreover, a ten per cent increase applied in the low-wage division of the national income means a ten per cent increase in business, since this money would all be spent in consumption.

In short then, the significance to industry and to the workers of a relatively small percentage increase in consuming power has been indicated.

II

SO MUCH for increased consumption. It remains to describe the possibilities of curtailed production capacity. Please note that the words "curtailed production capacity" are used rather than "curtailed production," with which everyone is only too familiar at the present time. It is my intention that the actual expansion of plant should be avoided rather than the painful process which has occurred in nearly every industry, where plant facilities that were greatly expanded are now necessarily operated at a very low level of capacity.

Any number of charts and tables could be presented to show the phenomenal growth of industry in the United States during the last decade. It seems safe to assume that anyone old enough to read this discussion will have an adequate recollection of the type of optimistic data so widely presented during the boom period.

It is interesting, however, to examine the statistics published by the *Commercial & Financial Chronicle* regarding the issue of new capital:

TABLE VII

CHARACTER AND GROUPING OF NEW CORPORATE ISSUES IN THE UNITED STATES

New Capital (exclusive of refunds)

(000,000 omitted)

	1930	1929	1928	1927	1926
Railroads	$ 797	$ 547	$ 364	$ 506	$ 346
Public utilities	2,365	1,932	1,811	2,065	1,500
Iron, steel, coal, copper, etc	201	274	208	100	193
Equipment manufactures	27	2	9	24	19
Motors and accessories	16	82	66	95	131
Other industrial and manufacturing	520	1,177	852	705	527
Oil	262	271	194	317	263
Land, building, etc	245	520	716	630	709
Rubber	34	90	56	13	43
Shipping	10	31	21	26	21
Inv. trusts, trading, holding, etc	233	2,222	786	175	71
Miscellaneous	234	1,490	994	734	436
Total new corporate securities	$4,944	$8,639	$6,080	$5,391	$4,357

In this table are listed the different purposes for which the itemized amounts of new capital were raised. Of particular interest is the significant increase in new capital for industrial manufacturing and for investment trusts, which occurred in 1928 and 1929. Recalling that the figures given apply only to corporate financing and that money reinvested from earnings by corporations or individuals or partnerships is not included, it seems altogether probable that the figure of $10,000,000,000 estimated by the Government in 1929 is within reason.

It is important to note that the $8,640,000,000 raised for new corporate enterprises in 1929 represents an increase of roughly 7½% on the total of $115,000,000,000 of assets of all industrial corporations in existence in this country at that time. It is also significant that the estimated total of $10,000,000,000 investment in total new expansion corresponds to more than 10% of the national income.

In other words, it appears that the business men of the country were expanding their plant facilities at a rate probably in excess of 7½% per year at a time when the country's long term trend of growth of population was 1.5%, of wealth was 1.7%, of income was 3%, and of volume of production between 3% and 4%.

Not very many people are arguing now that the high rate of expansion of industry in 1928–29 was economically justifiable. The question is raised whether the country would not be far better off if the funds raised for new corporate financing had been diverted to financing new consumption by the large group of the population whose average income barely suffices for subsistence, as was pointed out in a previous section. There, it will be recalled, it was shown that a 20% increase in the average income of each member of this group resulted in a total increase in income of close to $10,000,000,000, which corresponds roughly with the $10,000,000,000 expenditure estimated for expansion of new enterprises.

The bare subsistence class supplies the need which would result in increased consumption if the credit could be obtained. The more affluent group has invested the money in expansion of plant facilities largely not used to date. One wonders how painful the arbitrary appropriation of the capitalists' $10,000,000,000 would have been, in view of the possible use thereof and of subsequent events. No such radical suggestion is made as a definite plan. In fact, no plan is offered. As was stated before, the object of this study was to describe the relative magnitudes of the sums involved in order to aid in a clearer statement of the problem.

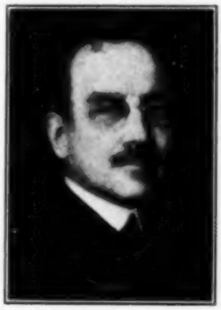
That the public is in a mood for serious measures is pointed out by Mr. Owen D. Young in his discussion of the Swope Plan: "The people who are calling for economic planning really mean what they say. Are they willing to surrender their individual freedom to the extent necessary to execute the plan?"

Would this question even have been asked a few years ago? Now, however, the problem is before us and must receive serious consideration.

Adequate Chemical Training

By Herbert R. Moody

A distinguished professor of chemistry gives his conception of what the chemist should study. The importance of breadth of training.



I WAS trained at the Massachusetts Institute of Technology by Professor Thomas M. Drown, one of the old-time giants of the profession. In those days comparatively few colleges trained chemists. Manufacturers used their services less and knew less about what training was best. Employers often came to Dr. Drown to ask for a "steel chemist" or a "cement chemist" or a "flour chemist." Dr. Drown invariably replied that he had no steel, cement, or flour chemist but that he *had* young men whose training would make them at home in any field of chemistry.

A long time has elapsed since those days; but, like Dr. Drown, I feel that it is useless to train a man for a specific field of work. He may change his mind after graduation; or circumstances may never offer him the opportunity for his specialty.

I do believe in a student selecting the specific broad field in which he hopes to do his life work—analytical, physical, industrial, chemical engineering, etc. But after making such selection, I feel that he must not wholly avoid courses in the other departments.

One never knows into what field fortune will lead him. My brother, who was taking the electrical engineering course at M.I.T., bitterly complained in his junior year that he was obliged to study heat treatment of metals. "I am not going to be a blacksmith," he argued, "and what has this work to do with electrical engineering?" But to

his great surprise it was of immense advantage to him. His early professional years were spent with the newly formed Thompson Electric Welding Company, where all he had learned about heat treatment was invaluable.

Analysis Still Valuable

I should certainly not advise a boy who is planning to be a manufacturing chemist to slight analytical chemistry. In fact, I am still strongly of the opinion that all chemists ought to be masters of the theory and technique of quantitative analysis. I know that practical analysis is now reduced almost to routine, capable of being done by high school boys. But a chemist without the foundation of analytical technique seems to me to be handicapped in any field of chemistry.

Another branch which every chemist ought to master is bibliography. I find young chemists unaware of the desirability of preparing for research or the adoption of a new process by thorough study of the literature. Even if aware of the desirability they have scant knowledge of the proper procedure. The very names of the journals are unfamiliar to them. And how many young S.B. graduates know how to hunt down an organic compound in Beilstein?

Importance of Breadth

Our field is now so huge and so sub-divided that it is impossible to lay down a fixed curriculum as exactly what a student should follow for a particular training. But I certainly stress *breadth* of college experience to prevent strangeness in whatever field presents itself. I stress elementary and advanced inorganic and much training in organic and analytical chemistry. In this I include special branches, such as water analysis, gas analysis, and fuel analysis. The student after graduation may never be a gas analyst—very likely he never will; but I know that the technique derived in such courses is an invaluable asset. And, though I have left it to the last, I cannot too strongly urge, for equipping the chemist of today, *several* courses in physical chemistry and its close associate, colloid chemistry.

In closing, I must recommend several years of oral and written English. Constant complaints come to me: "Why cannot chemists write a proper letter—a proper report—keep good records?" "Why cannot they make an impressive, convincing oral report to their employers in conferences?"

CHEMISTRY AND BUSINESS

Research Can Save the South

Abstract of speech delivered by Dr. Charles H. Herty before the Southern Newspaper Publishers Association.

THE South just now is interested in finding a crop which can be grown at a profit, and which thus will bring about the South's economic revival. Cotton under present conditions cannot be this crop. Pines can be. Some day the pine tree and not cotton will be king of the South.

Especially valuable potentially is the slash pine, now little known and still less understood. It grows twice as fast as the white pine and produces lumber and naval stores. Even more significant, however, is the fact that the young trees trimmed out from the planting are suitable for newsprint and other white paper. This makes it possible to build a great paper industry on a waste product.

Paper men have avoided slash pine, considering it too resinous. Research has shown that this is a fallacy. The Forest Products Laboratory has already announced the manufacture of newsprint from slash pine.

Only a little chemical research, coupled with industrial foresight, is needed to transfer the pulpwood industry of Canada to the South. With its advantages in climate and consequent faster growth, the South can easily outstrip northern competitors. All that is needed is sufficient research to fill out the existing outline with enough substantiating facts to persuade capital to move its investments. Wood, even now, costs a third as much in the South as it costs in the North. In addition there are other industrial advantages, notably the ability to run on a small reserve without fear of freezing.

Already Southern mills are making container board and kraft paper profitably, while Northern mills are losing money.

President Butler of Columbia reminds us that now, as has happened before, "The whole world is waiting for something to turn something up, but somebody has got to turn something up." Owen D. Young's

comment is that "Facts are the least developed of our natural resources. We must make our people research-minded."

Investors are beginning to ask about any company, "What is it doing in the way of research?"

In this particular case not much research is needed. The South is the future home of the white paper industry, if the South goes about it courageously, intelligently, and persistently.

Chemistry as an Industrial Buffer

By Benjamin T. Brooks

THE present economic depression is due to a variety of primary and contributory causes; and my own impressions are that no one has succeeded in evaluating these in a conclusive way.

It seems to be generally believed that the mechanization of industry has reached the point where all of the world's necessary goods can be produced by a relatively small fraction of the world's labor. But the chemical industries, I believe, can be charged with very little, if any, of this dislocation of labor. Chemical industries become of importance only in a highly developed industrial community; they are practically non-existent in frontier communities and backward countries. In many cases, they represent new creations. In certain relatively rare cases, a chemical plant has destroyed an older industry (for example, the serious curtailment of the production of natural indigo and the madder dyes), but its general effect upon agriculture has been one of great stimulus. The sugar refining and the corn products industries have given employment to thousands in the plant and many more thousands in the fields by extending the use of these refined products.

The refining of petroleum has built up a ten billion dollar industry and has also made possible the automobile industry. One might go through the whole catalogue with many more illustrations of this kind. Had it not been for the creation of new chemical industries and the hundreds of special industries dependent upon chemical products, acute economic distress would have been caused by the mechanization of industry many years ago. The creative chemical industries may be considered as having been a "buffer" absorbing many thousands of men in their employ.

Harvey Firestone, Industrialist

By James R. Crowell

How a chemical industry arose from the meditations of a level-headed young man. Vision and a practical mind the cornerstone of a notable success.

PROBLEMS have always fascinated Harvey S. Firestone, one of the great leaders of the industrial world, and the more difficult they are the better he likes them. Problems exact tenacity of purpose to master them. Since earliest youth the distinguished tire manufacturer and rubber pioneer has been nothing if not tenacious. His father and mother instilled in him the traits that make for rugged, determined character, an inconquerable spirit.

Underwood & Underwood Studios

HARVEY S. FIRESTONE

"Complete every task you begin, no matter how difficult, how tedious, or how long it might take you to finish it." That was the teaching of his parents, farmer folks of Ohio. His schoolmates and his teachers report that the parental precept began manifesting itself in boyhood. His friends who have witnessed his rise from a humble start in the business world to its crest know how forceful this characteristic of hanging on, plus native foresight, has been in his serene domination of the most intricate situations. On more than one occasion in these later years he has watched millions melt away as a result of violent economic upheavals. During none of those troublous periods did he lose mastery of himself or the serious tasks in hand. He did not permit circumstances to conquer him. He conquered circumstances.

Considering his profound interest in problems, it is not strange that

it was a problem which started him on his way to becoming the active head of one of the largest chemical concerns in the world, devoted to the manufacture of tires and other rubber products, principally products used by automobilists. In the latter part of 1895 he was twenty-seven years old, newly married, and a resident of Detroit. Years before that he had left his parents' farm at Columbiana, Ohio, to make his own way. Now, in early manhood, he was regarded by his associates as a successful young man, ambitious to go ahead, a hard worker, an apostle of detail, a salesman who had complete faith in the value and utility of the commodity he offered for sale.

Into this setting of steady progress dropped an impediment. The buggy manufacturing company which he represented in Detroit was forced to the wall because competitors began selling similar vehicles at a much lower price. Young Firestone found himself facing an age-old problem. The bridegroom establishing a home for himself and wife was out of a job. But where other men have despaired in the face of that predicament, he accepted it philosophically. There was only one thing he could do about it—he would get himself another job. And a better job, if that could be arranged. Why not turn the liability of having no employment into the asset of having better employment?

It has always been one of Firestone's habits to go into seclusion with his own thoughts when working out perplexing questions. He did on the occasion in question. He went for a ride through the streets of Detroit in the buggy he had been using to demonstrate to prospective customers. The horse jogged lazily along; the driver's mind worked with progressive sureness.

The buggy in which he rode was the only one in Detroit which had rubber tires. Rubber-tired vehicles were a new and novel thing. America knew little about them; they were not generally on the market, and anyone who wanted a set of the tires might have had difficulty in learning where to go to get them. They were being introduced in England at about the same time they made their appearance here. A London cab company had equipped its vehicles with them some years previously. But neither here nor in Europe was anybody at all sure that rubber tires were entirely practical. There was as much uncertainty about their eventual destiny as there was about airplanes a few years ago.

As he drove along in his buggy that afternoon, Mr. Firestone's thoughts turned to the soft cushioning effect of the rubber which encircled the wheels of the vehicle. Vision and imagination opened a

great vista of the future. If rubber tires added so immeasurably to his own driving comfort, why would not everybody come to recognize sooner or later that they possessed incalculable benefits? And if that premise was correct, why would it not be well for him to go into the business of making and selling rubber tires? No reason why, that he could see. So then and there, while buggy riding in Detroit, the young bridegroom out of a job became a 100 per cent tire man—in spirit, if not in actuality at that moment.

Here in this decision we see another trait which has always been one of Mr. Firestone's outstanding characteristics. He did not rush pell mell into conclusions. It has been his lifelong practice to fortify himself so that it would not be necessary for him to act on hasty judgment which afterward might prove to be unsound. In this instance he could take a little time. He was not in desperate need of money. Back of him were savings which amounted to $1000, a neat sum at that time.

Firestone Plant, Akron, Ohio

What he needed to go ahead with was capital. So, he got that. One afternoon he took a Chicago friend for a drive in the buggy and demonstrated the advantages of rubber tires. When they sat down at dinner that evening, he acquainted this friend with what he had in mind, namely, that he wanted him to furnish the capital to start a rubber tire factory. He "sold" the friend. The Chicago man knew of an old, run-down rubber factory on Wabash avenue near Harrison street, Chicago, which he thought they might be able to get. They did get it—for $1500 cash—and in that ramshackle building, with just one workman to help him and with machinery in a sad state of repair, Harvey S. Firestone started on the career which was to take him to the top in the present enormous industry of tire making. He did everything there was to do about the factory—made tires, sold tires, kept books, ran the business. It is an interesting fact that the tire industry and Fire-

stone have grown up together side by side, each integrally identified with the other.

Between those modest beginnings and the present magnitude of the Firestone Tire and Rubber Company, with activities reaching all over the world, there is a long succession of steps. It is significant that in none of them has Firestone ever made a backward move. Within two years after opening the Chicago plant he had bought out a competitor and enlarged the business. Then there was a merger with another company to bring about further expansion, and by the dawn of the new century he had become a leader in the buggy tire business. It was at that time, in 1899, that he sold out his Chicago interests and established himself in Akron, Ohio, which has since been the home of the great industrial organization over which he presides.

Improvement of products and improvement of facilities of manufacture, as well as the observation of sound selling methods, have formed the byways along which Mr. Firestone has journeyed to amazing success. He has always said that instinctively he is a salesman and not a manufacturer, and yet he has been the keenest of students concerning manufacturing development. His mind has been flexible. He has never held that because established methods of doing work were gaining results, they could not be improved upon. And thus he has from the outset always been quick to introduce any innovation which proved itself practical on analysis. But there has always been that analysis. Any change has had to prove itself beyond a shadow of doubt before its adoption.

It is Mr. Firestone's philosophy on salesmanship which has perhaps been as much responsible as anything else for the growth of his organization and for his rise to industrial leadership. He says the first principle of salesmanship is that you must believe thoroughly in what you have to sell. Persuading a man to buy is not, to his notion, salesmanship. It is just persuading him to buy and nothing else.

"Therefore, I have never really had to sell at all—only to explain the favor I expected to do the prospect," Mr. Firestone says. "The principle holds true, whether one is selling tangible things, like a rubber tire, or whether one is selling something intangible like the future of a company, either in the shape of capital stock, or in the shape of credit at a bank."

From time to time he made improvements in the old solid rubber tire and the method of attaching it to the wheel. Then came the pneumatic tire, with all the radical upheaval it was to cause in the

rubber industry. Harvey S. Firestone saw its tremendous advantages. He changed over his organization to accommodate itself to the new conditions.

It was anything but a path of roses for his company in those days; he has never wanted to travel a path of roses, believing that an absence of resistance to what you are doing has a tendency to make you overconfident and lazy. The "breaks" against his company were recognized as an inevitable part of the ebb and flow of business fortune, but the "breaks" for his company were the result of careful planning and wise leadership.

One of the most favorable of the latter happenings was an order from Henry Ford for two thousand sets of pneumatic tires for the old Model T automobile. This order marked the beginning of close business relations between the two companies that have continued ever since. The personal friendship existing between Mr. Ford and Mr. Firestone is also widely known. The camping trips they have taken with Thomas A. Edison and the late John Burroughs have received world-wide attention.

Here is a brief recapitulation to show the steady growth of the Firestone organization. In 1902 he had 12 persons working for him. In 1904 he had an average of 35. In 1905 he had 130 workers on his payroll and then, five years later, it had climbed to 1000. In 1917 there were 10,000 employes working for his company and in 1920 this huge army had almost doubled, reaching 19,800. The financial growth in those same years, between 1902 and 1920, was along parallel lines. In 1902 he did a business of $150,000. In 1920 he did a business of $115,000,000. In 1929, before the present period of business depression, sales had mounted to $144,585,000.

Mr. Firestone's capacity for weathering great financial storms has added to his prestige. Few heads of great enterprises have ever had to face a more trying situation than he had to deal with in the depression of 1920–21. In that period, coming as a climax to boom times and huge inflation, he saw the company's large inventories drop in value approximately $20,000,000. The company's total indebtedness exceeded $45,000,000 and sales had practically stopped. Here is how Mr. Firestone explained the measures he used to combat this serious condition:

"We called in our sales organization, held dealers' meetings in all the leading cities and towns, and took full pages in the newspapers to advertise a cleanup sale at a twenty-five per cent discount. Our dealers took hold of this campaign, we sold $18,000,000 worth of merchandise

One of the First Tires and One of the Latest

in September and October of 1920 and closed that year with a bank indebtedness of $31,000,000."

In succeeding months the same relentless pressure continued throughout the organization to effect economies and stimulate activities as a means of offsetting the tremendous hardships imposed by depressed business conditions. Mr. Firestone went personally to important bankers and showed them it was better to get the losses behind his organization and inventories down, and then start making profit. The financial statement he presented to them was remarkable for its frankness, but it carried the day. When he closed the books, October 31, 1924, his company did not owe one dollar to any bank.

Rising from all the vast minutiae growing out of the development of so enormous an organization are several periods which stand out in the mind of the man who has been at the helm. One of these was the experience of 1920–21 just referred to. Another concerns the active campaign which he waged against the Stevenson Restriction Act by which British production of rubber on Middle Eastern plantations was seriously curtailed and prices for crude rubber greatly increased. In his battle to nullify this selfish embargo on so essential a commodity,

Mr. Firestone received no support from his associates in the rubber industry. He could not make them see the untenability of a situation whereby the capital of one country controlled eighty-five per cent of the world's supply of a raw material and another country used seventy per cent of that supply. That was the status of British capital control of rubber and America's consumption of it. Not only did the whole status of production and consumption impress Mr. Firestone as being artificial and economically unsound, but it seemed to him especially unfair for Great Britain to take advantage of it.

The vigor with which he carried on his campaign against the Stevenson Restriction Act is well remembered. Marshalling facts and figures to prove that the ultimate victim of such arbitrary action would be the American automobile owners, Firestone, single-handed, initiated the movement which resulted in the appropriation of $500,000 by Congress to find new sources of rubber. This Congress did without a single dissenting vote. Eventually, after six years, the ill-starred Stevenson legislation was written off the British books.

British rubber growers have learned an everlasting lesson from this attempt to saddle rubber consumers with unfair prices. Not only did the Dutch rubber growers refuse to become a party to the Stevenson plan, but they extended their plantations, improved their methods, and became for the first time worthy competitors of Great Britain in rubber plantation operation. There was, however, still another significant outcome of it all. Mr. Firestone insisted that Americans should produce their own rubber, and a slogan phrased in exactly those words had telling effect in carrying the message to the world. Mr. Firestone himself gave practical application to the thought by leasing one million acres of rubber land in Liberia, giving him one of the largest plantations in existence.

In the personal side of his life Mr. Firestone has become famous for several outstanding characteristics. His love of home has always been predominant. He has never forgotten that he began life as a farmer boy. The farmer instinct still lives in him and finds expression in the tremendous interest he takes in his two farms, one at Columbiana, Ohio, where he was born, and the other forming a part of his beautiful estate, "Harbel Manor," within the city limits of Akron.

There is no diversion he enjoys more than getting out on either of these farms and working the implements or looking over his splendid herd of cows. He prefers it many times over to the customary recreations of men who enjoy great wealth, such as cruising around the world on palatial yachts.

There is a large place in his heart for the Columbiana farm, known as "The Old Homestead." It was there he grew up and gained his first impressions of life under the tutelage of a father and mother to whom he was tremendously devoted. In the years which have passed since those days, Mr. Firestone has been thrown in contact with the foremost business leaders of the world, but he has always said that he has never known a better business man than his father was. Around the old homestead hover memories of the frugal earlier days, the tender care exercised by his parents in bringing up the family; and it has afforded him the keenest pleasure that the workings of fortune have made it possible for him to restore the original homestead and to surround it with the things which he thinks would have delighted the hearts of his parents.

Mr. and Mrs. Firestone have five sons and one daughter. Harvey S. Firestone, Jr., the eldest of the sons, is vice-president of The Firestone Tire and Rubber Company and in charge of the work in Liberia. It was, in fact, Mr. Firestone, Jr., who worked out the endless detail in connection with the launching and operation of that enterprise. Russell and Leonard, two other sons, have also entered the service of the Firestone Company and its many subsidiaries, the former now being the vice-president of the Firestone Tire and Rubber Company in California. The two other sons will follow this lead upon completing their education.

New Design

A FEW minor structural changes have been made in *The* CHEMIST. It is planned, however, to continue the present volume until the first of the year, using the same general form. Beginning with 1932, *The* CHEMIST will go on a twelve-issue basis, probably with an entirely new design.

CONTEMPORARY THOUGHTS

Professionalism and Science

Excerpts from an editorial in *Nature*, June 27, 1931

ONE of the main features of the development of science during the 19th Century is the twin growth of technology and professionalism. Science was then for the first time conceived as a vast mine of ideas for utilization in practical life; and scientific workers rapidly passed from amateur to professional status.

The professionalism of science is one aspect of the specialization which confronts the educationist of today. The complexity of modern science and the industrial technology demand intensive specialization and tend to encourage the growth of various scientific professions. At the same time, the growth of professional organizations among scientific workers and the marked movement toward registration in post-War Europe, while likely to assist in the participation of scientific workers in public affairs, are not without their own special dangers.

The specialized knowledge and restricted outlook of scientific workers have hindered the establishment of right relations between science and leadership. Few scientific specialists could be named whose knowledge and opinions would be accepted as having much weight outside the narrow field in which they pursue their special researches. In many cases their training has not even equipped them with the powers of expressing the results of their work.

Scientific Sterility

Chemists, physicists, and other scientific workers are frequently characterized by a celibacy of intellect which curiously resembles the physical celibacy practiced by the learned in the Middle Ages. This celibacy of intellect on the part of individual scientific workers is one of the main causes of the ineffectiveness of their professional organizations, which are rarely able to secure sufficient support from the general body of members for the success of policies originated by a few more fertile minds. If the future of society largely depends on our ability to link administrative power with knowledge of the scientific factors

involved in our modern problems, that combination can only be secured when the scientific worker adds to his knowledge the wisdom which is the fruit of the balanced development.

Poorly Balanced Education

The problem is fundamentally educational. Our present educational system on one hand produces administrators, frequently of a high order of ability, but whose complete ignorance of science renders them incapable of understanding the scientific factors upon which all our modern problems turn. On the other hand, the tendency to excessive premature specialization produces a diversity of specialists often devoid of the political or social wisdom essential for the evaluation of the other factors involved.

The problem of education must be faced by professional organizations of scientific workers if they are to assume their responsibility of leadership. It is essential that a sufficiently high standard of general education should be demanded of all entrants to such professions, that premature specialization should be discouraged, and that qualifications for entry to the profession of science should depend more upon the ability to apply and use knowledge than possession of an acquaintanceship with a mass of undigested scientific facts. A danger of undue uniformity may arise, however, if the conditions of entry are too nearly prescribed in closing a profession by a measure of registration.

Scientific progress depends on more than mere advances in technique. In the perfecting of technique and the evaluation of corporate research the professionalism of science has thus largely been developed. Professionalism will, however, defeat itself if it succeeds to any great degree in cramping individualism and forcing on scientific workers a mediocre uniformity. Progress depends on the spirit of adventure, and the spirit of science is one of questing and search in the unknown, with its attendant risks of success and failure.

Organization Pitfalls

The more economic necessity forces on scientific workers the development of their professional organizations, the more jealously they must cherish high ideals of craftsmanship and of service, and guard against the sterilizing influence of excessive specialization and uniformity. Moreover, the very security which strong professional organizations ultimately confer on their members may itself be a snare to scientific workers.

Security is but a means to an end, and the first effect of professional organization should be to improve the condition of employment of scientific workers, so that they can carry on their investigations without undue financial anxieties. Such security makes for better workmanship by increasing the freedom of the investigator. When, however, it becomes an opiate and the absence of competition prevents the sharpening of mind on mind, security has outlived its purpose. The powerful professional organizations tend to suffer from a species of inbreeding of intellect, or mental sterilization. It is not in an atmosphere of security and uniformity that great discoveries are made or creative ideas conceived.

Specialization is a necessary evil under modern conditions. Professionalism is essential to maintain and advance high standards of technique among scientific workers. Vocational guidance must play its part in reducing the wastage of human material in unsuitable occupations. If in such ways the freedom, resources, and efficiency of the scientific worker are increased, it is incumbent upon him to see that there is no dimming of the spirit of adventure, the devotion to truth, the sincerity of purpose which are behind every great discovery of the past and which still supply the driving force in the advance of science.

Civil Service Examinations

THE United States Civil Service Commission announces the following open competitive examinations:

ASSOCIATE CHEMIST (INDUSTRIAL HYGIENE INVESTIGATIONS)
ASSOCIATE CHEMIST (ANY SPECIALIZED BRANCH)
ASSISTANT CHEMIST-PETROGRAPHER
ASSISTANT CHEMIST (ANY SPECIALIZED BRANCH)

Applications must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than December 30, 1931.

The examination is to fill vacancies in the Bureau of Mines, for duty at Pittsburgh, Pa., New Brunswick, N. J., and elsewhere in the field. Vacancies in other branches of the service will also be filled from those examinations.

The entrance salaries for the associate positions range from $3200 to $3800 a year, for the assistant positions from $2600 to $3200.

Competitors will not be required to report for examination at any place, but will be rated on their education, training, and experience, and on their thesis or published writings.

Full information may be obtained from the United States Civil Service Commission, Washington, D. C.

Charles E. Munroe, Government Expert

By J. N. Taylor

How and why a great government chemist became great. An able teacher becomes the country's leading expert on explosives.

CHARLES E. MUNROE

THE return of autumn calls forth pleasant recollections of an old college building and of throngs of students returning to their classes after the summer vacation. In the mind's eye one sees a large amphitheater rapidly filling. Expectant eyes are fixed upon a door near the lecture table. An announcer's bell rings, the door opens, and, commanding instant attention, there quickly enters the well-known figure of a white-haired man of unmistakable distinction.

* * * *

The beloved teacher of years ago is still active. Now professor *emeritus,* he none the less "carries on," at the age of over four score years, with more vigor than is evidenced by some of his younger contemporaries. Any week-day but Saturday will find him at the Bureau of Mines engaged in the solution of some difficult problem or immersed in some highly technical study.

It is difficult to write about Professor Munroe without becoming eulogistic. To look in *Who's Who* and find that he was born in 1849 impels one to say—as Dr. Wiley once put it—"Munroe is a 'forty-niner'—pure gold."

His entrance into chemistry was somewhat incidental. Because of his father's devotion to horticulture as a pastime, young Munroe had

planned to pursue agriculture; but at the age of eleven, while convalescing from an illness, he entertained himself by reading, *The Boston Cultivator*. In this journal he read "Liebig's Letters on Agriculture" and learned of the close relationship between agriculture and chemistry.

It now appeared to him that he ought to study chemistry first. To that end he fitted up a laboratory at home With the aid of McCauley's *Natural Philosophy*, Stockhardt's *Principles of Chemistry*, and Francis' *Chemical Experiments*, he taught himself so well that when he entered the high school, he was made at once a laboratory assistant.

His later chronological history has been so often recounted that it is well known to readers of *The* CHEMIST. After graduating from Harvard, where he taught for three years, he served successively at the United States Naval Academy, the Naval Torpedo Station and War College, and George Washington University.

Munroe's baccalaureate thesis at Harvard was on analytical methods and apparatus. Throughout his career this topic has appealed to him. He has devised many pieces of apparatus, among which may be noted his porous cone. In the making of this he developed a new principle for the production of fine and uniform pores throughout a biscuit of plastic matter. Before shaping and burning he incorporated within the plastic mass a volatile substance, preferably ammonium chloride. The porous material thus made was subsequently extensively used for biochemical filtrations in the Pasteur-Chamberland filter.

In the development of the application of porous cones to vacuum filtration, Professor Munroe devised the rubber gasket by which the cones could be hermetically connected with the filter pump. This rubber gasket was adopted by Professor C. C. Caldwell of Cornell University in his development of the perforated porcelain crucible and by Professor F. A. Gooch of Yale University in the development of his asbestos filter.

Later, Professor Munroe invented his metallic felt filters. Although he produced filters of finely divided metallic iron, nickel, copper, and other metals upon supports of the same or other materials, his preferred form for precise work was a felt of metallic platinum, supported in a perforated platinum crucible. The Munroe crucible has been much used in the determination of atomic weights, while the other metallic sponges have large scale uses in the chemical industries.

Following his invention of a porcelain biscuit of uniformly fine porosity, Professor Munroe applied it to the production of refrigeration by the use of water only, eliminating the use of ice. His prime object was to apply this method to refrigerator cars, where the motion

of the cars when under way would promote evaporation and consequent cooling. He also applied the method to household refrigerators. With water alone he secured temperatures as low as 56° F. in the hottest weather.

It was while at Newport that he invented *indurite,* the first smokeless powder adopted by the United States Navy for use in large guns. It is worthy of note that while the date of application of his patent is August 14, 1891, this must have been considerably antedated by the idea back of it. It was not until later that he enunciated the principle that the ideal smokeless powder "should be composed of a single chemical substance in a state of chemical purity"; but it is quite logical to conclude that the thought had its origin with him previous to the invention of any other modern smokeless powder.

Another remarkable discovery made by him while stationed at Newport was a principle of detonation. This discovery—known as the *Munroe effect*—throws a light on the nature of the detonation wave and may well be the key to airplane bombing. Briefly, he discovered that if letters, such as "U. S. N. 1884." were sunk into the face of a gun-cotton cube and this detonated in contact with a steel plate, the letters would be indented on the plate. If the letters were raised above the surface of the gun-cotton cube, placed in contact with the steel plate and the cube detonated, the letters would be faithfully reproduced on the plate as before, but raised above the surface. In other words, the molecules of explosive gathered energy as they traveled. By placing the ends of sticks of dynamite forming a bomb in echelon formation, those at the center of the group of sticks a few inches further from the end of the bomb than those on the outer edges, an increased penetrating effect could be obtained.

The results of some of Professor Munroe's experimental work are seen in the form of beautiful impressions made of leaves, laces, etc., upon squares of armor plate, fashioned into a unique fire screen and presented by him to the Cosmos Club. On his eightieth birthday he was presented at a complimentary luncheon with a medal bearing his likeness and made through utilization of the *Munroe effect.*

The topic of chemical technology has apparently made a particular appeal to Professor Munroe throughout his chemical life. Even as a boy constructive work appealed to him. The neighborhood of his birthplace was highly industrial. He spent much of his leisure time in glass, kerosene, gas, vinegar, and other chemical works, absorbing much information. While a student in college, he was employed by the New England Glass Company in the development of the hand

lantern, just then coming into use by the railroads. He advised the application to those hand lanterns of the catadioptric lenses developed by Fresnel for lighthouse lanterns. Since the gold ruby glass then being made was too expensive for these hand lanterns, he developed a cheap copper ruby glass.

In the field of commercial practice, his records show a large number of clients, among whom are many of the most important concerns in this and foreign countries. The subjects treated covered a wide range of industries. It is interesting to note that he has acted as adviser to consulting chemists of standing. He has been engaged as an expert by glass manufacturers, gas manufacturers, makers of pyroxylin plastics, makers of gas burners, rubber chemists, inventors engaged in the development of processes for the recovery of metals from their ores, cereal manufacturers, and in a great variety of other arts besides explosives. He has designed and erected several plants.

But, of this savant's many contributions, one cannot help feeling that his great work on industrial chemistry, prepared for the Bureau of the Census, is by far the most important. Combining with it the younger Silliman's contributions to American chemistry, presented at the Northumberland celebration of 1874, it would be possible to write the history of American chemistry.

In *Bulletin 210* of the census of 1900, Professor Munroe pointed out the close relationship of invention to manufacture, and emphasized the importance of correlating patents with the data of production in arriving at any true estimate of the growth of manufacture. The first to point out this relation, he has summarized many thousand patents in the chemical industry. In the course of his census work, he personally reviewed many thousand patents.

Professor Munroe appeared first as an expert in patent litigation in 1871, in the famous nickel plating patents, which are so frequently cited in patent literature. He has since that time repeatedly appeared in a great variety of issues. He was long the chairman of the Committee on Patents of the American Chemical Society. Within a few years a former Commissioner of Patents, when being questioned on the witness stand as to Professor Munroe's standing as a patent expert, exclaimed, "Why, his name is written all through the Patent Office."

Professor Munroe's practice, in other litigation than patents, has been extensive, and has covered a very wide range of issues. His wide acquaintance with the literature has been of especial value. In an issue before one of the highest United States Courts, the Court, on reading Professor Munroe's testimony, said: "That is what we regard

as true expert testimony." The award was made to Professor Munroe's client to the last penny claimed by him.

Professor Munroe, at a meeting of the National Advisory Council, stressed the importance of explosives in the mining of fuel, and the necessity for the supervision of explosives. He forced recognition of the fact that coal-mine accidents are factors to be reckoned with in determining the extent and availability of our mineral-fuel resources. Immediately on the formation of the Technologic Branch, he was designated as its consulting explosives chemist. His association with this enterprise has been continuous since 1907. He has also been a member of the National Research Council since its inception.

During the World War the Federal Government, for the first time in history, exercised control over all explosives in the United States. Professor Munroe was most actively associated in the initiation, development, and operation of this war measure. Today he is recognized as the foremost American authority on the chemistry of explosives. He has been selected for high office by many societies at home and abroad, and he has received numerous degrees and orders. His brilliant government service as consulting expert to many departments is well known. His contribution to the progress of science, with particular reference to the development of our nation's industries, is outstanding. And during more than a half century of teaching chemistry, Professor Munroe's activities were not confined to the university lecture room. He contributed to the general knowledge through his public lectures.

In addition to direct educational work, he has maintained an active interest in organizations which diffuse knowledge. He is interested also in the chemist as a human being. His contributions to the literature of chemistry testify eloquently to the inestimable service which he has rendered to his profession. He is a former vice-president of the American Association for the Advancement of Science, a past-president of the American Chemical Society, and he has held office in many other scientific bodies and societies. He is an honorary member of The American Institute of Chemists and has contributed greatly to its influence.

To depict the man himself is difficult. Munroe is something of a paradox. While one of our oldest, he is yet one of our youngest Although experience must of necessity bring sophistication, he is yet as ingenuous as when the world was younger. Birthdays record our growth in grace, not years, and Munroe becomes more gracious every day. His ready sympathy, his modulated voice, his clear, twinkling

eyes, his hearty laughter, his power to inspire, are some of the things which make it a privilege to have him for a friend.

His boyhood dream has now been realized. He is renewing his contact with Nature on an estate large enough to be self-supporting. Literary and scholastic doors have led to the garden paths of his country place at Forest Glen, with its delightful home set in the midst of beautifully landscaped lawns. Abundance, but not extravagance. Everything is at hand, from library and workshop to poultry and woodyard; from his extensive vegetable gardens and orchards to Mrs. Munroe's lovely flower gardens.

He delights to see his friends. It is a treat to go out there on a Sunday afternoon and visit him. He has had many interesting experiences, and he tells about them with rare humor. While attending the ceremonies of starting the Corliss engine at the Philadelphia Centennial Celebration, he was thought to be a visiting nobleman, with amusing complications. Once, while traveling in Europe, he was mistaken for royalty, and the castle guard was called out to accord him full honors.

Professor Munroe's contribution to the advancement of the human race cannot be estimated. His unceasing activity, marked ability, and a high idealism, have combined to make the world richer and better.

Positions Wanted

The following chemists are available for positions. Further information will be furnished upon application to the American Institute of Chemists, 233 Broadway, New York, N. Y.

101-XX Chemist experienced in analysis of metals, rubber, paper. Some research experience.

101-QT Ph.D. with wide experience in food products. Head of laboratories of various canning companies.

101-PQ Chemistry professor. 15 years' teaching experience.

101-IN Chemical engineer experienced in high vacuum and the chemistry of air gases.

101-ZN Research and plant chemist experienced in cement, leather, high explosives, acids, fertilizers.

101-MO Research chemist experienced in explosives, dye intermediates, acids.

101-HW Paper chemist, research and development work.

101-DP Recent graduate, industrial position.

101-ID Chemical engineer, nine years' experience plant work and management.

OUR AUTHORS

"The Chemist in Industry"

Moses Leverock Crossley, Ph.D. (Brown), F.A.I.C., went from his position as head of the organic chemistry department at Wesleyan to Calco Chemical Company, where he became chief chemist, a position he still holds. His fields of particular knowledge include the dye industry, nitrocyclic compounds, valency, the chemical physiology of human hair, and the question of phosphorus as an index to nerve metabolism.

Since 1915 he has been consulting chemist to the Middlesex Hospital.

The Institute has long profited from his energetic work and from his keen, incisive comments at meetings of the National Council.

Adviser to South America

Henry Arnstein, F.A.I.C., born in New York, was educated in Budapest, Berlin (Sc.D.), Heidelberg (Doc. Engr.). After six years as chemist and plant manager in various countries of Europe, he returned to America to design plants for the Fleischmann Yeast Company. Since then he has designed many plants for many chemical purposes in the United States, South America, Canada, the West Indies. He is widely sought as chemical consultant and efficiency engineer, Krupp's being perhaps his most famous client. The leading chemical authority on South America, he is retained by various Latin-American governments as special technical adviser.

Fortune prints Dr. Arnstein's photograph among "Faces of the Month" for October, and tells about his experiments in substituting alcohol for gasoline as an automobile fuel. He drives his own alcoholic car.

Employment Expert

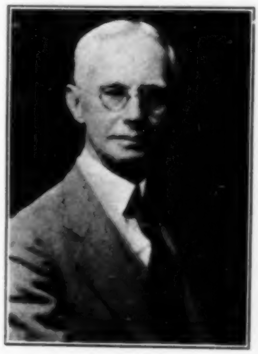
D. H. Killeffer, an alumnus of North Carolina, began his career in the chemical profession by working on smokeless powder, then on dyestuffs with Calco. After editorial experience on the staff of *Drug and Chemical Markets* and the *Scientific American*, he became associate

editor of *Industrial and Engineering Chemistry*, a position he held until 1928, when he became a director of research of the Dry Ice Corporation. Now the energetic manager of the Employment Bureau of The Chemists' Club, he is finding jobs for chemists and chemists for jobs. He is also once more doing editorial work for *Industrial and Engineering Chemistry*. A prolific writer, he has contributed to many publications and has written one book.

Authority on Business Research

David P. Morgan, Jr., F.A.I.C., went to Middlesex School, then to Harvard College, then to Columbia University (Ph.D.). After a year at Harvard Medical School as National Research Fellow, he spent three years as a member of a firm of consulting chemists, giving advice particularly about colloids. People valued his business judgment also. Now he is a chemical economist with Scudder, Stevens, and Clark, a New York investment house. Tall, broad-shouldered, athletic, Dr. Morgan plays squash at the Harvard Club.

Plans for the South



Charles H. Herty, Ph.D. (Hopkins), F.A.I.C., a native of Georgia, has long been interested in the chemical and economic problems of the South. He spends much of his time there away from his office on Park Avenue, New York. He is an industrial consultant. Specialty: locating industrial plants. Other interests: double halides, oleoresins, new methods of turpentine orcharding. Inventions: turpentine cups, other devices for naval stores industry.

"Adequate Chemical Training"

Herbert R. Moody, Ph.D. (Columbia), F.A.I.C., is professor of industrial chemistry at the College of the City of New York. Of wide chemical interests, he has specialized in electric furnace products, the fixation of nitrogen, petroleum purification, bread and other food products, technical fibers and straws.

Munroe Biographer

James Norman Taylor, F.A.I.C., chief of the organic division of the Bureau of Foreign and Domestic Commerce, has been with the government throughout most of his scientific career. His particular field is insecticides. An enthusiastic browser in libraries, Dr. Taylor has written voluminously. Chemical industry knows him as the expert dispenser of much government chemical knowledge. Popular among fellow-chemists, he is famous for his pleasant, genial disposition and for his willingness to help others with their problems.

"Chemistry as an Industrial Buffer"

Benjamin T. Brooks, Ph.D. (Göttingen), F.A.I.C., spent sixteen years in industry, five of them doing petroleum research at the Mellon Institute. Now, as a consultant, he dispenses the knowledge thus acquired. He is the author of 13 patents, 40 publications, and one book (*Non-benzenoid Hydrocarbons*). Tall, virile, distinguished, Dr. Brooks is often to be seen at The Chemists' Club, where he is noted for his definite ideas, his excellent bridge.

Firestone Biographer

James R. Crowell began his writing career on the editorial staff of the *New York Evening Telegram*. Then he became London correspondent of the *Herald*, and traveled through many countries as a special writer. Of late years Mr. Crowell has been engaged in magazine writing, principally for the *American Magazine* and the *Saturday Evening Post*. Two of his serials in the *Post* have been published in book form: "The Spell of the Turf," and "The Fifth Estate."

BOOK REVIEWS

A History of Chemistry. By F. J. Moore, late Professor of Organic Chemistry, M.I.T. Revised by William G. Hall. *McGraw-Hill.* $3.00.

The history of chemistry tells of theories long abandoned, of men long dead, and of work largely superseded. Yet the subject continues to hold the interest of all members of the profession. Not a few of its greatest men, like the late E. F. Smith, have made it their hobby. The reason is that chemistry has a history full of human interest and is almost more a story of men than of the growth of a science. No chemist can be familiar with the developments of his profession without feeling a glow of pride. Whatever the grade of his ability, he is a brother in a long chain of great men.

Professor Moore's *History* well exemplifies this point of view. With each development in the science the figure of a man is linked. This has always been done by historians of chemistry's early years, despite the fact that personal data are so scarce as to leave the figures mere wraiths. This reviewer thus learns to his surprise that there is doubt of the existence of Basil Valentinus. When it comes to the later days of chemical history, Professor Moore's method is particularly apt. Not only is the name of a man given with the outline of his work, but often the man is so portrayed as to stand up from the pages in the prime of his vigor. A splendid lot of fighting men they were. To the pampered professional worker of today, with every resource of the world a tool in his laboratory, it is ever a cause for renewed wonder that our fathers in the profession achieved the results they did. It has been the unanimous habit of our historians to applaud particularly the work of Stas. Professor Moore with justice praises many others—Ramsay, Victor Meyer, and Mosely, to select a few instances. And further, he continues his history down to the present day and in the United States, so that a number of men but recently dead receive biographical attention.

The present volume is a second edition, which in itself is proof of the merit of the book. Revision is by Professor William G. Hall. Physically it is a well-made volume, with almost 80 plates of eminent chemists of the past and present. The reviewer recommends it.

Karl M. Herstein

Science in Action. By Edward R. Weidlein and William A. Hamor. *McGraw-Hill.* $3.00.

I always pick up with a heavy heart a book dealing with the history of science in America. The opening chapter, I feel pretty sure, will discuss phlogiston and Joseph Priestley. It was a particular delight, therefore, to find that Doctors Weidlein and Hamor had apparently never heard of phlogiston; and a further irreverent feeling of pleasure rose from the dismissing of Mr. Priestley with a single line.

Science in Action is the book of the scientist in practical affairs. It tells of the chemist on the battle-front of the world about us, discussing science in its industrial, medical, and financial aspects, rather than the mistier frontier of pure research. We see modern names: J. E. Teeple, L. V. Redman, M. C. Whitaker, E. R. Squibb, and the Radio Corporation of America. A glance at some of the illustrations conveys further the tone of the book. We find pictures of Paul Revere's copper mill, of the manufacture of sausage casings, the stamping out of iron washtubs, a bread-baking oven.

The authors, director, and assistant director of the highly diversified Mellon Institute, are peculiarly fitted to talk about the chemist in the world today. They have given us a glimpse of the operations going on over the whole field of American industry. They make a gesture also at the problems of industrial management, the international and financial aspects of research, the whole question of the economic significance of the scientist and his work. Their only unfortunate choice, perhaps, was to point to the Winchester Arms Company, now in receivership, as an example of successful business diversification.

The printing is excellent, the half-tones rather less well done. The literary style is a trifle cumbersome, though after the book gets started, it tells so many things so rapidly that it "marches" anyhow. This reviewer must confess a certain small, faint feeling of annoyance, however, at such words as "societal," "archetypal," and "bibliochrestic."

There is hardly an American scientist who cannot learn something from reading *Science in Action*, and hardly a layman who will not find it interesting. E. L. G.

INSTITUTE NOTES

OFFICERS

FREDERICK E. BREITHUT, *President*
Brooklyn College
Brooklyn, N. Y.

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Applications for Membership

THE following applications for membership will be acted upon by the National Council of the Institute, at its next meeting:

FELLOWS

ROBERT VAUGHAN BROWN, Plant Manager, Calco Chemical Co., Inc., Newark Works, Newark, N. J.

LYLE A. CLOUGH, Organic Research Chemist, Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.

CHARLES CUTHBERT CONCANNON, Chief Chemical Division, Department of Commerce, Washington, D. C.

RUSSELL CASPER ERB, Professor of Chemistry and Head of Dept., Philadelphia College of Osteopathy, 48th and Spruce Streets, Philadelphia, Pa.

DANIEL DANA JACKSON, Executive Officer & Professor, Department of Chemical Engineering, Columbia University, New York, N. Y.

WALTER S. TYLER, JR., Research Chemist, Tide Water Oil Co., Bayonne, N. J.

HERMAN DELIUS WEIHE, Junior Chemist, Bureau of Chemistry and Soils, Department of Agriculture, Washington, D. C.

ASSOCIATES

A. FRANK BOWLES, Chief Chemist, Hymes Brothers Company, 37 Howard Street, New York, N. Y.

EDWARD LEE GORDY, Editor, *The* CHEMIST, 233 Broadway, New York, N. Y.

HAROLD H. HERR, Teacher of Science, Teaneck High School, Teaneck, N. J.

FERDINAND FRANCIS EMANUEL KOPECKY, Chemist, Bakelite Corporation, 230 Grove Street, Bloomfield, N. J.

WALTER LORD OBOLD, Head of Dept. Biological Sciences, Drexel Institute, Philadelphia, Pa.

JUNIORS

HARRY P. DALALIAN, 118 Linwood Avenue, Philadelphia, Pa.

HUGH AUGUSTUS D'AMATO, 125 North Third Street, Jeannette, Pennsylvania.

FERDINAND PHILIP HELLER, Graduate Scholar, Cobb Chemical Laboratory, University, Virginia.

ABRAHAM L. METERSKY, Independent Laundry Company, 361 Herzl Street, Brooklyn, N. Y.

HERBERT G. WISEMAN, Assistant Chemist, Department of Agriculture, Experiment Station, Beltsville, Md.

The following Associates have applied for transfer to the rank of Fellows:

CHARLES A. MARLIES, Tutor, Department of Chemistry, College of the City of New York, New York, N. Y.

MARY AUGUSTA ROLLAND, Research Chemist, Reed and Carnrick, 157 Van Wagenen Avenue, Jersey City, N. J.

Pennsylvania Chapter

A GET-TOGETHER meeting was held at the Engineers' Club, Tuesday, September 22, 1931. F. D. Jones presided. Mr. Cayo reported on the proceedings of the Annual Meeting at Washington and also on the 82nd Council meeting. F. D. Jones reported on the 83rd Council meeting.

Reports of the national committees, as published in the June issue of *The* CHEMIST, were discussed, and two resolutions were drawn up, copies of which are to be sent to each councilor. One resolution thanked the Council for its very fine work on behalf of the Institute. The other was a motion approving the definition of a chemist contained in paragraph 2, page 327 (*The* CHEMIST, June, 1931) of the report of the Committee on Professional Education.

The following committees were appointed:

Tours: Franklin D. Jones, *Chairman*, Messrs. Porter, Stoertz, Mellanoff, and Proskuriakoff.

Membership: Max Trumper, *Chairman*, Messrs. Chapin, Kilpatrick.

Constitution: William Stericker.

Schedule of Meetings, 1931-32

New York Chapter:

Oct. 9, 1931

Nov. 13, 1931

Dec. 11, 1931 Joint Meeting (A.I.C. in charge) Society of Chemical Industry, American Chemical Society, Société de Chimie Industrielle, American Electrochemical Society.

Jan. 15, 1932

Feb. 5, 1932

Mar. 4, 1932

Apr. 1, 1932

May 6, 1932

Pennsylvania Chapter:

Nov. 3, 1931 Symposium, "'Publication of Research Results."

Dec. 1, 1931 Educational Trip.

Jan. 5, 1932 "The Status of the Chemist in Russia."

Feb. 2, 1932 Speaker from the New York Chapter.

Mar. 1, 1932 Educational Trip.

Apr. 5, 1932 Joint meeting: Philadelphia County Medical Assn. *or* Am. Inst. Chemical Engineers

NEWS

Douglas R. Pinnock, F.A.I.C., has been made works manager of the Agash Refining Corporation, 99 Hudson Street, New York, N. Y.

Ira Paul, F.A.I.C., has been appointed technical and laboratory engineer with the Department of Public Works, State of New York, and is in charge of the laboratories for the Division of Highways and Engineering.

A tentative list of speakers and subjects for the Third International Conference on Bituminous Coal to be held at the Carnegie Institute of Technology, Pittsburgh, November 16th to 21st, has been announced by **Dr. Thomas S. Baker,** President of Carnegie Tech and organizer of the meetings.

The preliminary program contains the names of almost 100 speakers who will contribute to the world meeting, which is expected to attract 2000 persons from seventeen countries. The desperate plight of the coal industry has added considerable impetus to the meeting.

The Salesmen's Association of the chemical industry held their annual golf tournament at Briarcliff Lodge, Tuesday, September 15th, under the direction of Grant A. Dorland, Chairman. The tournament was followed by a dinner and entertainment in the Casino, which brought to a close the summer season of the Salesmen's Association.

The results: Low gross, Al Alvarez, Grasselli Chemical Company, 85. Low net, Rupert Lowe, Bakelite Corporation, 76. Kickers' competition, Grant A. Dorland, MacNair-Dorland Company, 73.

Medal to Redman

The Grasselli Medal will be presented to Dr. L. V. Redman, F.A.I.C., at a joint meeting of the Society of Chemical Industry with the New York Section of the American Chemical Society, American Electrochemical Society, and Société de Chimie Industrielle on November 6, 1931. The award has been made for his paper entitled, "Cost of Research and Its Apportionment," presented at a meeting of these societies on December 9, 1927.

The place where the meeting is to be held will be announced later.

Lonnie C. Elmore, A.A.I.C., recently commissioned second lieutenant in the Chemical Warfare Officers' Reserve Corps, has been assigned to the 301st Chemical Regiment in the Fourth Corps Area.

A. George Stern, A.A.I.C., is now associated with A. R. Maas Chemical Company, Los Angeles, Calif.

According to the National Safety Council, of twenty-eight major industries the chemical industry ranks tenth in frequency of accidents. It ranks fourteenth in severity.

Accidents are most frequent in coal-tar

distilling plants and least frequent in plants manufacturing carbon products.

Chemistry in the New Waldorf-Astoria

American chemists are playing a large part in the effects produced in the new Waldorf-Astoria Hotel. Fabrics and carpets have taken a large quantity of synthetic dyes, according to E. I. duPont de Nemours and Company. Forty years ago such an industry did not exist.

In addition, new lithopone and dry colors are being used in wall-covering material. American chemicals and ceramic colors are being used in 144,000 pieces of dinner service. Coloring pigments are being employed in 300,000 square feet of bathroom tiles for more than 2000 rooms.

Robert J. Moore, F.A.I.C., manager of the varnish-resin development department, Bakelite Corporation, addressed the Rotary Club at Niagara Falls, N. Y., August 31st, on "New Developments in Protective Coatings."

Dr. Willard C. Thompson, F.A.I.C., has been appointed professor of chemistry at the Georgia State College for Men, Tifton, Georgia.

With **J. C. Miller** as president and treasurer, a new company, Michigan Chemicals, Inc., has been organized in Grand Rapids to develop and manufacture chemicals and chemical compounds. The company will also act as Michigan distributor for the Grasselli Chemical Company and the Harshaw Chemical Company.

Maximilian Toch, F.A.I.C., will succeed his brother, Henry M. Toch, as president of Toch Brothers, Inc. (paints and varnishes), and will also continue as vice-president of the Standard Varnish Works.

Dr. Toch, chemist and artist, is famous for his research work on paints and for the fact that he frequently wins photographic competitions. He is an authority on the chemistry and technology of paints.

Dr. Toch's clubs are The Chemists', Camera, City Athletic, Cosmos (Washington).

F. J. Barr and **E. H. Bohle** have accepted graduate assistantships in chemistry at the University of Illinois, Urbana, Ill.

Russell C. Erb, professor of chemistry at the Philadelphia College of Osteopathy, will deliver a lecture on chemistry during the October session of the Middle Atlantic States Osteopathic Convention.

J. W. Crawford, F.A.I.C., has resigned his position as superintendent of the G. H. Tilton and Son Company to become superintendent of the Sulloway Mills, Franklin, New Hampshire.

Frederick E. Breithut, president of The American Institute of Chemists, has been elected an Honorary Member of the Chemical, Metallurgical, and Mining Society of South Africa.

New Research Foundation

A fellowship created sixteen years ago has been expanded into a research foundation. The Rex Research Foundation, with headquarters in Chicago, will work on intensifying public education as to the need for continuous chemical warfare against insect pests. **O. F. Hedenberg,** director of the foundation, will endeavor to replace such measures as "swat the fly" campaigns with chemical warfare that will exterminate both pests and germs.

Nitrate Research Award

The Chilean Nitrate Bureau has again provided for the Chilean Nitrate of Soda Nitrogen Research Award. The intent is to foster work on the role of nitrogen as a fertilizer. Any research chemist in the United States or Canada is eligible. Anyone wishing to call the attention of the committee to his own work or to that of any other worker should communicate before November first, with Richard Bradfield, Department of Soils, Ohio State University, Columbus, Ohio.

The Schoellkopf Medalist

Frank J. Tone, winner of the Schoellkopf medal, doesn't spend all his time discovering abrasives and new alloys. Fishing also occupies part of his time. We have in the office of *The* CHEMIST a picture of Mr. Tone with a thirty-two pound trout. Success is evidently a habit of his, no matter what his field of activity.

Another favorite sport is hunting, the love of the chase apparently having come down to Mr. Tone from his Irish ancestors. He is descended from a family well known in Irish history which settled in New Jersey in 1760.

In 1901 Mr. Tone was married to Miss Gertrude Franchot, after whom was

named his second son, now playing the leading role in "The House of Connelly," the Theatre Guild production at the Martin Beck Theater. His oldest son, Jerry Tone, was a famous football and baseball player at the Tome School and at Cornell.

Mr. Tone's clubs are the Niagara, Niagara Falls Country Club, Rotary, The Chemists' Club (New York), Gatineau Club (Point Comfort, Quebec).

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